REMARKS

The Office Action of October 17, 2003 has been received and its contents carefully considered.

Claims 1 to 20 are all the claims pending in the application, prior to the present amendment.

Claims 1, 5 to 11, 15, 16 and 20 have been rejected as obvious over EP 0 583 062 to Harada in view of PCT Publication WO 00/58536 to Nishimura et al.

The WO Publication is in the Japanese language. In the Office Action, the Examiner refers to its English language equivalent, U.S. Patent 6,489,026 to Nishimura et al.

Applicants submit that EP '062 and WO '536 do not disclose or render obvious the presently claimed invention and, accordingly, request withdrawal of this rejection.

The present invention as set forth in claim 1 as amended above is directed to an electrical insulating vapor grown carbon fiber having a fiber diameter of 0.01 to 0.5 μm, a hollow part in the center of the fiber and a boron concentration of about 1 to about 30% by mass in terms of a boron element, wherein the surface thereof is partially or entirely coated with an electrical insulating material of an inorganic compound or composition and the amount of boron in a depth of 1 nm from the surface of the vapor grown carbon fiber is about 10% by mass or more, based on the entire mass of the vapor grown fiber having a depth of 1 nm from the surface.

Thus, applicants have amended claim 1 to recite that the electrical insulating material is of an inorganic compound or composition, and that the amount of boron in a depth of 1 nm from

the surface of the vapor grown carbon fiber is about 10% by mass or more, based on the entire mass of the vapor grown fiber having a depth of 1 nm from the surface. In view of this amendment applicants have canceled claim 4. Applicants have amended independent claims 11 and 16 in a similar manner.

The present invention as set forth in claim 6 is directed to a method for producing an electrical insulating vapor grown carbon fiber, comprising mixing a boron compound with a vapor grown carbon fiber having a fiber diameter of 0.01 to 0.5 μm to form a mixture and heat-treating the mixture at 2,000°C or more in the presence of as nitrogen compound.

EP '062 pulverizes a vapor grown carbon fiber (VGCF) which is graphitized. The pulverized, vapor grown and graphitized carbon fibers of EP '062 has a high packing density, and can be used to form molded members and composite members with high packing density in a resin.

EP '062 discloses at page 3, lines 51 to 53, that the vapor grown and graphitized carbon fibers of EP '062 can be used to form molded members and composite members having high electrical conductivity. EP '062 discloses at page 4, lines 1 to 3, that the composite materials and the composite molded members are highly electrically conductive materials. In the Examples of EP '062, the electric conductivity which is superior has been shown. Thus, EP '062 does not disclose or suggest a vapor grown carbon fiber that is coated with an electrical insulating layer.

EP '062 describes, at page 3, line 55 -57, that composite materials may be prepared by compounding a VGCF with a plastic material, a rubbery material, a metallic material, a ceramic

material, a paint, an adhesives, or the like with a high packing density. The composite members of EP '062 can impart a good state to their molded products, and contain the VGCF at high packing density. The molded members of EP '062 consist solely or substantially solely of the VGCF, so that the VGCF can be in contact with one another to such a sufficient extent that they are provided with "remarkably high electrical and thermal conductivity", as disclosed at page 12, line 35-44 of EP '062.

The coated material of Example 1 of EP '062, comprised of VGCF and phenol, which is shown in Table 1, at page 7, had a Surface Resistance of 3.8, 4.3 and 7.3 Ω, depending on the amount of phenol.

With respect to the recitation of claim 1 that the surface is partially or entirely coated with an electrically insulating material, the Examiner states that EP '062 to Harada discloses that the vapor grown fibers can be compounded with a plastic material, a rubbery material, a ceramic material or a metallic material, as disclosed at page 3, lines 28 and 29 and 54 to 57 of EP '062. The Examiner states that the mixing of the vapor grown carbon fibers of EP '062 with a rubber material necessarily results in fiber surfaces that are partially or entirely coated with an electrically insulating material.

In response, applicants point out claims 1, 11 and 16 now recite that the electrical insulating material is of an inorganic compound or composition. Thus, the disclosure of EP '062 of a rubber material does not satisfy the recitations of these claims of an electrical insulating material made of an inorganic compound or composition.

Further, the resin or rubber that comes into contact with the surface of VGCF in EP '062 represents a state where the VGCF is covered with the resin or rubber, but this is a state as a composite material, and differs from a state where the electric insulated material is formed or locked on the VGCF surface itself as in the present invention.

In the present invention, the electric insulated material is formed by the VGCF itself, and the VGCF itself shows an electric insulating property.

EP '062 also shows a composite material comprised of VGCF and ceramics, but applicants submit that the ceramics are not formed to the fiber, and are merely present in a mixed state.

With respect to the fact that EP '062 does not disclose a boron content of about 1 to 30%, the Examiner relies on the Nishimura et al teaching of vapor grown fibers containing boron in an amount of 0.1 to 3 mass%, and argues that it would have been obvious to use boron in EP '062.

In response, applicants point out that claims 1, 11 and 16 recite that the amount of boron in a depth of 1 nm from the surface of the vapor grown carbon fiber is about 10% by mass or more, based on the entire mass of the vapor grown fiber having a depth of 1 nm from the surface. Neither EP '062 nor Nishimura et al disclose or suggest this recitation.

With respect to the method recitations of claims 6 to 11, the Examiner relies on the teachings of EP '062 for its use of an inert nitrogen gas during heat treatment, and relies on Nishimura et al for a teaching of the use of a boron compound.

In response, applicants point out that EP '062 discloses at page 4 that the graphitization may be carried out in an inert gas atmosphere, such as nitrogen, helium, argon and so on, but the Examples of EP '062 only disclose the use of the argon gas.

In Nishimura et al, the mixture of vapor grown carbon fiber and boron or a boron compound are subjected to heat treatment in a non-oxidizing atmosphere, preferably an inert gas such as argon, as disclosed at column 10, lines 16 to 17. The Examples of Nishimura et al only disclose the use of argon gas.

In the present invention, the heat treatment of VGCF is performed at approximately 2,000 to 3,000°C under a boron compound as a boron source and a nitrogen compound as a nitrogen source.

As the nitrogen compound, not only a N_2 atmosphere can be employed, but also, NH_3, urea, N_2H_4 or a compound capable of generating N_2 upon reaction can be employed as the nitrogen compound. In addition, the boron compound serves not only as a source of boron nitride coated on the VGCF surface, but also to improve the carobn crystallinity of VGCF. See, page 8, lines 15 to 30 of the present specification.

Applicants submit that EP '062 and Nishimura et al do not disclose or suggest the method of claims 6 to 11 and new claim 21.

In view of the above, applicants submit that the subject matter of claims 1, 5 to 11, 15, 16, 20 and 21 is not disclosed or suggested by EP '062 and WO '536 and, accordingly, request withdrawal of this rejection.

Claims 2 to 4, 12 to 14 and 17 to 19 have been rejected under 35 U.S.C. § 103(a) as obvious over EP '062 in view of WO 00/58536 to Nishimura et al and further in view of Chung.

Claims 2 to 4, 12 to 14 and 17 to 19 are dependent claims and, accordingly, are patentable for the same reasons as discussed above.

Further, claims 2, 12 and 17, and the claims dependent thereon recite that the electrically insulating material is boron nitride.

The Examiner states that EP '062 does not disclose the use of boron nitride as the insulating material.

The Examiner states that Chung teaches a particulate carbon complex comprising vapor grown carbon fibers impregnated with metal catalyst and heated in a nitrogen-containing atmosphere which are used to form composites. The Examiner states that the composites matrix materials can be metals, ceramics, glasses or polymers, and more specifically, boron nitride. The Examiner argues that it would have been obvious to use as the matrix material of EP '062 any matrix material known in the art, such as the boron nitride of Chung.

The Examiner concludes by stating that the combined teachings of EP '062, Nishimura et al and Chung would have rendered obvious the subject matter of the above claims.

The Chung patent discloses a carbon complex comprised of a carbon substrate impregnated with metal catalyst, and a plurality of carbon filaments which have a first end attached to the substrate. The carbon complex of Chung can be used to form composites with other dissimilar materials, such as boron nitride. The composite materials are formed by

blending the particulate carbon complex with these dissimilar materials in solid particulate form or an liquid form.

Chung states that when using a solid blending technique, the carbon complex of their invention is advantageous because it is in a particulate form, and can be more easily dispersed than can conventional carbon fibers or carbon filaments harvested from substrates. See column 7, lines 5 to 10.

The composite materials of Chung, comprised of carbon fiber and boron nitride, is in the form of a mere mixture of carbon fiber and boron nitride, and is not in the form where the boron nitride partially or entirely coats the surface of the carbon fiber. Since the composite of Chung is a mere mixture of the boron nitride and the carbon fibers, as opposed to a coating of the carbon fibers, applicants submit that Chung does not teach or suggest an electrically insulating boron nitride which coats a vapor grown carbon fiber.

Boron shows the role of a catalyst in order to make a high carbon crystallinity. The boron makes the boron and the nitrogen which exist on the fiber surface to connect, and then boron nitride exists on the fiber surface to cover the fiber surface. Therefore, the present invention not only provides a boron nitride electrically insulating coating, such as from a boron source and a nitrogen source, but also improves the crystallization of the carbon fiber at 2000°C or more.

In view of the above, applicants submit that the cited prior art does not disclose or render obvious the presently claimed invention and, accordingly, request withdrawal of this rejection.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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